

CLAIMS

What is claimed is:

1. A heater system comprising:
 - a thick film heater defining:
 - a substrate;
 - a dielectric layer disposed on the substrate;
 - a resistive layer disposed on the dielectric layer, the resistive layer having sufficient temperature coefficient of resistance characteristics such that the resistive layer is a heater element and a temperature sensor; and
 - a protective layer disposed over the resistive layer; and
 - a two-wire controller in communication with the thick film heater, wherein the two-wire controller determines temperature of the thick film heater using the resistance of the resistive layer and controls heater temperature accordingly.

2. A heater system comprising:

a thick film heater comprising at least one resistive layer, the resistive layer having sufficient temperature coefficient of resistance characteristics such that the resistive layer is a heater element and a temperature sensor; and

a two-wire controller connected to the resistive layer, wherein the two-wire controller determines temperature of the thick film heater using the resistance of the resistive layer and controls heater temperature accordingly.

3. A heater system comprising:

a thin film heater comprising at least one resistive layer, the resistive layer having sufficient temperature coefficient of resistance characteristics such that the resistive layer is a heater element and a temperature sensor; and

a two-wire controller connected to the resistive layer, wherein the two-wire controller determines temperature of the thin film heater using the resistance of the resistive layer and controls heater temperature accordingly.

4. A heater system comprising:

a thermally sprayed heater comprising at least one resistive layer, the resistive layer having sufficient temperature coefficient of resistance characteristics such that the resistive layer is a heater element and a temperature sensor; and

a two-wire controller connected to the resistive layer, wherein the two-wire controller determines temperature of the thermally sprayed heater using the resistance of the resistive layer and controls heater temperature accordingly.

5. A heater system comprising:

a sol-gel heater comprising at least one resistive layer, the resistive layer having sufficient temperature coefficient of resistance characteristics such that the resistive layer is a heater element and a temperature sensor; and

a two-wire controller connected to the resistive layer, wherein the two-wire controller determines temperature of the sol-gel heater using the resistance of the resistive layer and controls heater temperature accordingly.

6. A heater system comprising:

a layered heater comprising at least one resistive layer, the resistive layer having sufficient temperature coefficient of resistance characteristics such that the resistive layer is a heater element and a temperature sensor; and

a two-wire controller connected to the resistive layer, wherein the two-wire controller determines temperature of the layered heater using the resistance of the resistive layer and controls heater temperature accordingly.

7. The heater system according to Claim 6, wherein the two-wire controller comprises a DC bias control for calculation of the resistance of the resistive layer.

8. The heater system according to Claim 6, wherein the two-wire controller comprises an AC bias control for calculation of the resistance of the resistive layer.

9. The heater system according to Claim 6, wherein the two-wire controller comprises high conduction angle firing.

10. The heater system according to Claim 6, wherein the two-wire controller comprises a shunt resistor for calculation of the resistance of the resistive layer.

11. The heater system according to Claim 6, wherein the two-wire controller further comprises a microprocessor.

12. The heater system according to Claim 6, wherein the resistive layer defines a pattern selected from the group consisting of spiral, rectangular, and circular.

13. The heater system according to Claim 6, wherein the two-wire controller further comprises firmware.

14. A heater system comprising:
 - a thick film heater defining:
 - a dielectric layer;
 - a resistive layer disposed on the dielectric layer, the resistive layer having sufficient temperature coefficient of resistance characteristics such that the resistive layer is a heater element and a temperature sensor; and
 - a protective layer disposed over the resistive layer; and
 - a two-wire controller in communication with the thick film heater, wherein the two-wire controller determines temperature of the thick film heater using the resistance of the resistive layer and controls heater temperature accordingly.

15. A hot runner nozzle heater system comprising:
- at least one hot runner nozzle;
 - a substrate disposed proximate the hot runner nozzle;
 - a dielectric layer disposed on the substrate;
 - a resistive layer disposed on the dielectric layer, the resistive layer having sufficient temperature coefficient of resistance characteristics such that the resistive layer is a heater element and a temperature sensor;
 - a protective layer disposed over the resistive layer; and
 - a two-wire controller connected to the resistive layer, wherein the two-wire controller determines temperature of the heater system using the resistance of the resistive layer and controls heater system temperature accordingly.

16. A hot runner nozzle heater system comprising:
 - at least one hot runner nozzle; and
 - at least one resistive layer disposed proximate the runner nozzle, the resistive layer having sufficient temperature coefficient of resistance characteristics such that the resistive layer is a heater element and a temperature sensor; and
 - a two-wire controller connected to the resistive layer, wherein the two-wire controller determines temperature of the heater system using the resistance of the resistive layer and controls heater system temperature accordingly.

17. A heater system for use with an existing temperature controller having at least one temperature sensor input and a power output, the improvement comprising:

at least one layered heater, the layered heater comprising at least one resistive layer, the resistive layer having sufficient temperature coefficient of resistance characteristics such that the resistive layer is a heater element and a temperature sensor; and

at least one two-wire module connected to the layered heater and to the temperature controller,

wherein the two-wire module determines temperature of the layered heater using the resistance of the resistive layer and transmits the temperature of the layered heater to the temperature controller input, and the temperature controller transmits the power output to the two-wire module.

18. A heater system comprising:

a layered heater comprising at least one resistive layer, the resistive layer having sufficient temperature coefficient of resistance characteristics such that the resistive layer is a heater element and a temperature sensor;

an electrical lead connected to the resistive layer;

a controller connected to the resistive layer through the electrical lead, wherein the controller determines temperature of the layered heater using the resistance of the resistive layer and controls heater temperature accordingly;

a common return device connected to the layered heater; and

a power source connected to the controller,

wherein the common return device provides an electrical return to the controller from the layered heater.

19. A method of operating a layered heater comprising the steps of:
supplying power to the layered heater through a set of electrical leads
to a resistive layer of the layered heater; and
calculating the temperature of the resistive layer using a two-wire
controller connected to the layered heater through the set of electrical leads,
wherein the resistive layer is a heater element and a temperature sensor.
20. The method according to Claim 19, further comprising the step of
resistance data calibration.
21. The method according to Claim 19, further comprising the step of lead
wire calibration.
22. The method according to Claim 19, further comprising the step of
temperature calibration.
23. The method according to Claim 19, further comprising the step of TCR
calibration.

24. A method of operating a layered heater in conjunction with a hot runner nozzle system comprising the steps of:

supplying power to the layered heater through a set of electrical leads to a resistive layer of the layered heater; and

calculating the temperature of the resistive layer using a two-wire controller connected to the layered heater through the set of electrical leads,

wherein the resistive layer is a heater element and a temperature sensor.